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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/917,874	07/31/2001	Yoshiaki Kuroki	Q65641	2065

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EXAMINER
OLSEN, KAJ K

ART UNIT	PAPER NUMBER
1744	7

DATE MAILED: 08/29/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

AS-7

Office Action Summary	Application No.	Applicant(s)	
	09/917,874	KUROKI ET AL.	
	Examiner	Art Unit	
	Kaj Olsen	1744	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-20 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3,6 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 1, 3-5, 13, and 15-19 are rejected under 35 U.S.C. 102(b) as being anticipated by Shibata et al (USP 4,642,174).

2. Shibata discloses a multi-layer gas sensor comprising a solid electrolyte member 14, a porous member 12, and a substrate (18 with or without element 15). Shibata teaches the use of an electrolyte member having a thickness of 100 microns, a porous member having a thickness of 100 to 200 microns, and a substrate 18 having a thickness of 200 to 600 microns (col. 3, lines 31-50 and 58-61; and col. 4, lines 11-18). Hence the porous member and substrate both have a thickness larger than the electrolyte member (including 1.5 times larger than the electrolyte member) and sandwich the electrolyte member (fig. 1). The substrate and porous member are disclosed as being constructed solely out of a magnesia-alumina spinel (col. 3, line 41 and col. 4, line 16). Hence the volume percent of the specified spinel in the porous member (i.e. R2) is 100% of the volume percent of the specified spinel in the substrate (i.e. R1). 100% is greater than 60%, 80%, 90%, and 95% as set forth by the claims. With respect to claim 18 (those limitations not covered above), the magnesium-alumina spinel is inherently a crystalline material and would thereby form crystals. With respect to claim 19, the component of highest volume

content in spinel is Al_2O_3. Alternatively, Shibata also teaches the suitability of alumina itself (i.e. Al_2O_3) as a ceramic material for the device (col. 3, lines 40 and 41).

3. With respect to the claimed porosities (on densities) of the porous member, Shibata teaches the use of a porosity of 5-20% (or a density of 80-95%, which overlaps the claimed ranges of porosity and density.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1, 3-5, 9, 11, 13, and 15-19 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Takahashi et al (USP 4,595,485).

7. Takahashi discloses a multi-layer gas sensor comprising an electrolyte member 3, a substrate 6, and a porous member 2. The electrolyte member thickness is disclosed as being

between 0.1 to 30 microns (see abstract), while the substrate is disclosed as being considerable thicker than the electrolyte (col. 5, lines 48-52). The upper portion of the porous member and the substrate sandwich the electrolyte member (fig. 6, 9). The porous member is described as being "not less than 1 [micron]" (abstract) with a specific example of 10 microns (col. 9, lines 51-54). Hence Takahashi would appear to anticipate the claim requirement that the electrolyte thickness to be less than the thickness of the substrate and porous member when the electrolyte of Takahashi is chosen to be 10 microns or less. However, because Takahashi is drawn to a broad range of porous member and electrolyte thickness without specific examples satisfying the claimed range, the examiner recognizes that Takahashi might not teach the claimed ranges with "sufficient specificity" as required by MPEP 2131.03. However, it would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Takahashi with an electrolyte thickness of less than 10 or 1 microns because Takahashi has taught that the thinner the electrolyte is made, the greater the conductivity is (fig. 2). Hence the thinner electrolytes in the specified range would provide the greatest sensor response. The use of a 1 micron electrolyte with a 10 micron porous member satisfies the claimed relationship of claim 13.

8. Takahashi also teaches the use of Al_2O_3 as the sole ceramic component for both the porous member and the substrate (see abstract and col. 9, lines 24 and 25). Hence the volume percent of alumina in the porous member (i.e. R2) is 100% of the volume percent of the specified alumina in the substrate (i.e. R1). 100% is greater than 60%, 80%, 90%, and 95% as set forth by the claims. With respect to claim 18 (those limitations not covered above), alumina is inherently a crystalline material and would thereby form crystals.

9. With respect to the claimed porosity or density, Takahashi specifically teaches the use of porosity of 30% (or a density of 70%) (fig. 4), which overlaps the claimed range of porosity or density.

10. Claims 2, 6-8, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shibata in view of Mase et al (USP 4,798,693).

11. Shibata set forth all the limitations of the claims, but did not explicitly specify having the mean grain size of the crystals for the substrate and porous member satisfy the claimed relationship of claim 2. However, the claimed relationship would appear to be satisfied when the porous material and substrate are constructed with the same grain sized starting materials (i.e. "A" in claim 2 would equal 1 under such a condition). Mase teaches in an alternate gas sensor that the various ceramic layers of the gas sensor should be constructed to have the firing shrinkage rate that minimizes warping and Mase also teaches one of the means for accomplishing that is to utilize ceramic pastes having the same particle sizes (i.e. the same mean grain size material (col. 2, lines 38-54 and col. 6, lines 34-47)). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Mase for the gas sensor of Shibata in order to minimize the warping of the sensor during the firing step of sensor construction or during the exposure of the sensor to high temperature exhaust gases. With respect to the limitations drawn to the porosity, density, or thickness of the various sensor components, the teaching of these limitations by Shibata were addressed above and have not been reiterated here.

12. Claims 2, 6-8, 10, 12, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi '485 in view of Mase '693.

13. Takahashi set forth all the limitations of the claims, but did not explicitly specify having the mean grain size of the crystals for the substrate and porous member satisfy the claimed relationship of claim 2. However, the claimed relationship would appear to be satisfied when the porous material and substrate are constructed with the same grain sized starting materials (i.e. "A" in claim 2 would equal 1). Mase teaches in an alternate gas sensor that the various ceramic layers of the gas sensor should be constructed to have the firing shrinkage rate that minimizes warping and Mase teaches that one of the means for accomplishing that is to utilize ceramic pastes having the same particle sizes (i.e. the same mean grain size material (col. 2, lines 38-54 and col. 6, lines 34-47). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Mase for the gas sensor of Takahashi in order to minimize the warping of the sensor during the firing or annealing step of sensor construction or during the exposure of the sensor to high temperature exhaust gases. With respect to the limitations drawn to the porosity, density, or thickness of the various sensor components, the teaching of these limitations by Takahashi were addressed above and have not been reiterated here.

14. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shibata '174 in view of Friese et al (USP 4,221,650) with evidence from the Practical Handbook of Materials Science.

15. Shibata set forth all the limitations of the claims, but did not explicitly teach the addition of a ceramic component from the substrate and porous member into the electrolyte. Friese teaches that the addition of insulating materials such as alumina or magnesium-alumina spinel to the electrolyte improves the thermal shock resistance and heat conductivity of the constructed

sensor (col. 3, lines 2-58). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Friese and add the alumina or magnesium-alumina spinel ceramic from Shibata to the electrolyte of Shibata to improve the thermal conductivity and thermal shock resistance of the constructed sensor. Friese specifies adding between 8 and 85% of the ceramic by volume, but does not specify the amount in terms of mass as set forth by the claim. However, the densities of zirconia, alumina, and magnesium-alumina as shown by the Practical Handbook of Material Science evidence that the specified volume range of ceramic from Friese still overlaps the claimed mass range of ceramic even when the small differences between the densities of zirconia, alumina, and magnesium-alumina are accounted for.

16. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi '485 in view of Friese '650 with evidence from the Practical Handbook of Materials Science.

17. Shibata set forth all the limitations of the claims, but did not explicitly teach the addition of a ceramic component from the substrate and porous member into the electrolyte. Friese teaches that the addition of insulating materials such as alumina or magnesium-alumina spinel to the electrolyte improves the thermal shock resistance and heat conductivity of the constructed sensor (col. 3, lines 2-58). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Friese and add the alumina or magnesium-alumina spinel ceramic from Shibata to the electrolyte of Shibata to improve the thermal conductivity and thermal shock resistance of the constructed sensor. Friese specifies adding between 8 and 85% of the ceramic by volume, but does not specify the amount in terms of mass as set forth by the claim. However, the densities of zirconia, alumina, and magnesium-

alumina as shown by the Practical Handbook of Material Science evidence that the specified volume range of ceramic from Friese still overlaps the claimed mass range of ceramic even when the small differences between the densities of zirconia, alumina, and magnesium-alumina are accounted for.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kaj Olsen whose telephone number is (703) 305-0506. The examiner can normally be reached on Monday through Thursday from 8:30 AM-6:00 PM. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner are unsuccessful, the examiner's supervisor, Mr. Robert Warden, can be reached at (703) 308-2920.

When filing a fax in Group 1700, please indicate in the header "Official" for papers that are to be entered into the file, and "Unofficial" for draft documents and other communications with the PTO that are not for entry into the file of this application. This will expedite processing of your papers. The fax number for non-after final communications is (703) 872-9310 and the fax number form after-final communications is (703) 872-9311.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist, whose telephone number is (703) 308-0661.

Kaj K. Olsen
Patent Examiner
AU 1744
August 14, 2002